

Biotube® ProPak™ Pump Package

System Description and Effluent Quality

Orenco's Biotube ProPak PVU and PVP pump packages are designed to transport filtered effluent from single- and dual-compartment septic tanks (septic/dosing tanks), as well as from pump tanks, to dispersal systems or secondary treatment. Because all of its components are designed to work together, ProPak reduces installation time and errors. In addition, PVP pump vaults are designed to be passively self-cleaning, extending cleaning and maintenance intervals.

All ProPak pump vaults include a Biotube filter cartridge for filtering solids from the effluent pumped out of the tank's clear zone. This reduces loading and clogging of downstream components. In turn, filtering extends the life of drainfields, secondary treatment systems, and other downstream components. When an Orenco Biotube ProPak pumping system is used in a properly sized, structurally sound, watertight septic/dosing tank, it can be reliably expected to reduce total suspended solids (TSS) by an average of more than 60%.

This document provides Orenco's design recommendations for using a ProPak pumping system to pump out of a single septic/dosing tank. Before using these design recommendations, please verify that they will meet or exceed applicable regulatory requirements in your area. Specific areas for consideration when designing with the ProPak are tank reserve volume, tank minimum liquid level, and minimum dose volume.

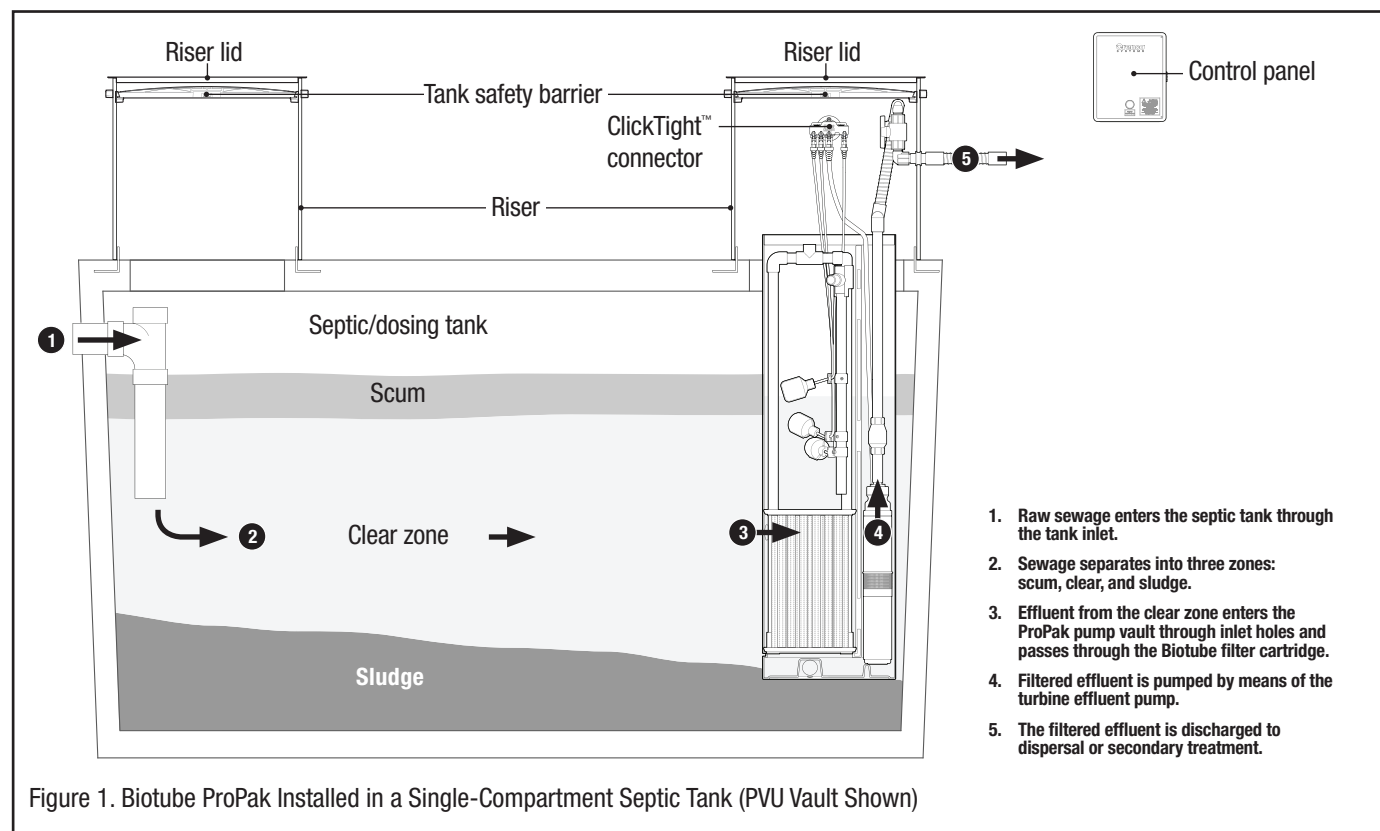


Figure 1 shows a typical single-family system with a ProPak in a single-compartment septic/dosing tank. Raw sewage enters the septic/dosing tank and separates into three distinct zones: a scum layer, a sludge layer, and a clear zone. The ProPak pump package draws effluent from the clear zone and filters it before pumping it to a drainfield, secondary treatment system, or other downstream termination point. In effect, the ProPak acts as a separate dosing tank inside of the septic tank, eliminating the need for additional dosing tankage outside of the septic tank.

An Orenco ProPak ensures high-quality effluent by baffling and screening large solids that could otherwise escape the septic/dosing tank. All Biotube pump vault designs help to retain sludge, scum, and other gross solids in the tank – even when biological agitation (bulking) of the tank's contents occurs. Thus, Orenco's Biotube pump vault technology provides sludge, scum, and gas baffling.

Pumping System

Figure 2 shows the components of a ProPak pumping system:

1. ClickTight or splice box –
 - The ClickTight provides secure, moisture-resistant cable connections between the control panel and ClickTight-compatible float switches and a ClickTight-compatible pump.
 - In the electrical splice box, wires from the control panel are spliced with the cords from the pump and float switches.
2. Biotube Pump Vault – Orenco's patented Biotube pump vault houses the float switch assembly, Biotube filter, turbine effluent pump, and discharge plumbing assembly. PVU-Series or passively self-cleaning PVP-Series vaults are available.
3. Biotube filter cartridge – The Biotube effluent filter with 1/8in (3.2mm) mesh removes approximately two-thirds of suspended solids. Filters with 1/16in (1.6mm) mesh are also available. The Biotube filter can be removed for cleaning without the need to remove the pump or pump vault.
4. Orenco 4in (100mm) turbine effluent pump – The pump moves filtered effluent to the distribution point. (See Appendix A.)
5. Float switch assembly – Float switches are affixed via collars to a quick disconnect float stem which is mounted onto the Biotube filter cartridge to monitor and control the liquid level inside the tank.
6. Discharge plumbing assembly – A discharge plumbing assembly connects the pump to the transport line.
7. Control panel – The control panel governs pump operation. It should be mounted within sight of the pump system. (See Appendix B.)

Accessory Equipment

The following products may be required to complete the system:

- Access risers with fiberglass lids
- Tank safety barriers
- Riser tank adapters with bolt-down kits
- Adhesive
- Grommets

Visit Orenco's website at www.orenco.com for more information about selecting these products.

Package Selection

All ProPak pumping systems are available with and without ClickTight and for both demand-dose and timed-dose applications. For more information on package selection, see the following Orenco technical data sheets:

- [Biotube ProPak 60Hz Pump Package, NTD-BPP-1](#)
- [Biotube ProPak 60Hz Pump Package with ClickTight Controls, NTD-BPP-2](#)
- [Biotube ProPak Pump Package 50-Hz INTL Series Pump Packages, NTD-BPP-1-INTL](#)

Design Tools

Orenco's PumpSelect™ software allows system designers and specifiers to select the correct pump for their application. When information about the drainfield is entered, the software calculates the pump flow rate and total dynamic head (TDH) required for the system. As an additional resource, see [Headloss Equations Design Aid, NDA-000-000-1](#).

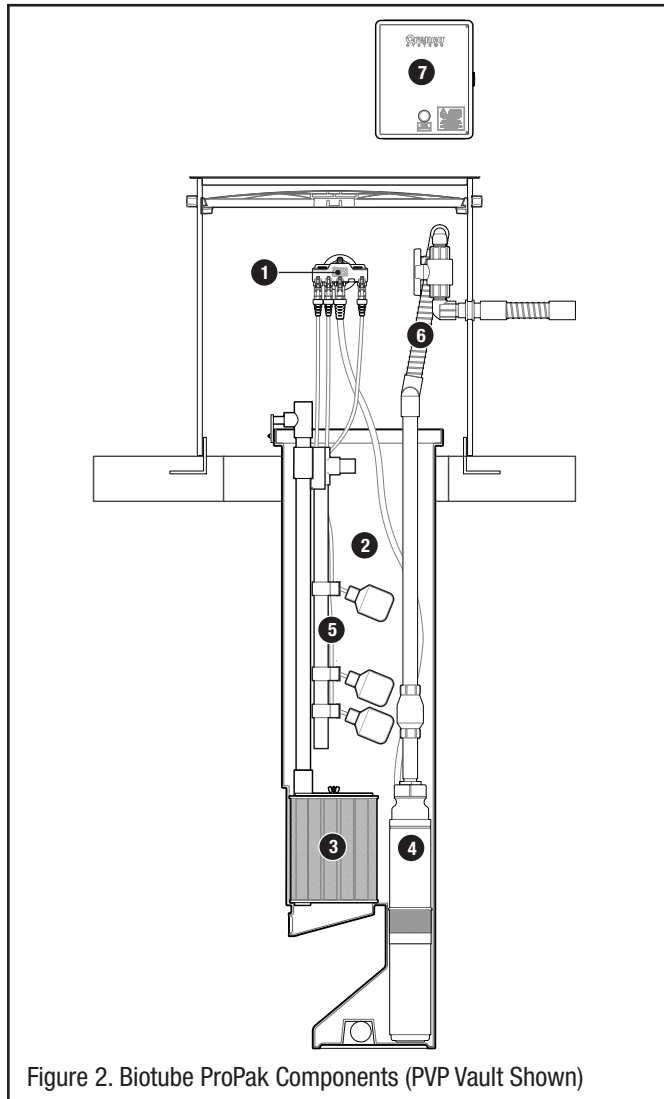


Figure 2. Biotube ProPak Components (PVP Vault Shown)

Septic Tank and Pump Vault Placement

Because septic tanks provide the initial treatment for any septic system, it is critical the septic/dosing tanks used with ProPak pumping systems are properly designed, structurally sound, and watertight. The ProPak can pump effluent from a single- or dual-compartment tank.

For pump flows less than 40gpm (< 2.52L/sec): Single-compartment septic/dosing tanks can be used. The drawdown in a single-compartment tank should be minimized to ensure sufficient retention and settling time are provided in the tank; this equates to sustaining a liquid volume of about 90% of tank capacity.

For pump flows greater than 40gpm (> 2.52L/sec): Because these higher flows may pull the floating scum layer into the inlet holes of the pump vault in a single-compartment septic/dosing tank, Orenco recommends a tank with dual compartments. Additionally, the liquid level in a dual-compartment tank should be kept as high as possible to maintain effluent quality. Scum and sludge layers develop in the secondary compartment – though less rapidly than in the primary compartment – so it is best to maintain surge and reserve volumes by using a dual-compartment tank with a shared liquid level. (See Figure 3.)

ProPak pumping systems are designed to draw effluent from the middle of the clear zone in the septic/dosing tank. For proper operation, the pump vault inlet or inlet holes need to be at 70% ($\pm 10\%$) of the distance up from the bottom of the tank to the lowest operating liquid level (“Off” float switch or “Timer off” float switch). (See Figures 4 and 5.) As scum and sludge accumulate in the tank, the location of the inlet or inlet holes ensures that the highest quality effluent is being filtered and transported out of the tank.

Float Switch Settings

Several factors affect system operation and float switch locations. These may include, but aren’t limited to the following: dose method, downstream components, and government regulations. Information provided in this section is intended to be used as a guideline.

The portion of the septic/dosing tank between the level of the “Off” float switch and the level of the “On” float switch (for demand-dose systems) or the “High-level alarm” float switch (for timed-dose systems) is called the operating zone.

Demand-dose systems are typically used to pump effluent to a gravity drainfield or downstream treatment system. The operating zone should be sized as small as possible to allow more scum and sludge storage in the tank and to minimize scum layer disturbance during pumping cycles. The minimum achievable operating zone for a ProPak system is 2in (51mm). This is as close as the “On” and “Off” float switches can be physically placed to one another.

Demand-dose float switch settings: Float switch settings for demand-dose ProPak applications are typically set to maximize the volume in the septic/dosing tank by establishing a small operating zone. Figure 4 shows general guidelines for float switch placement.

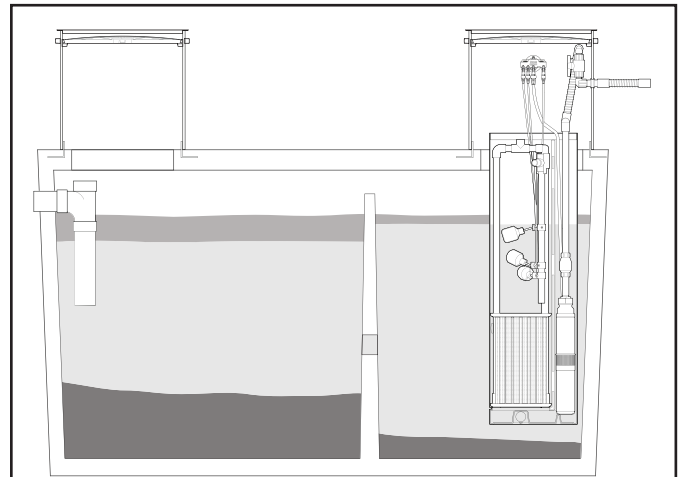
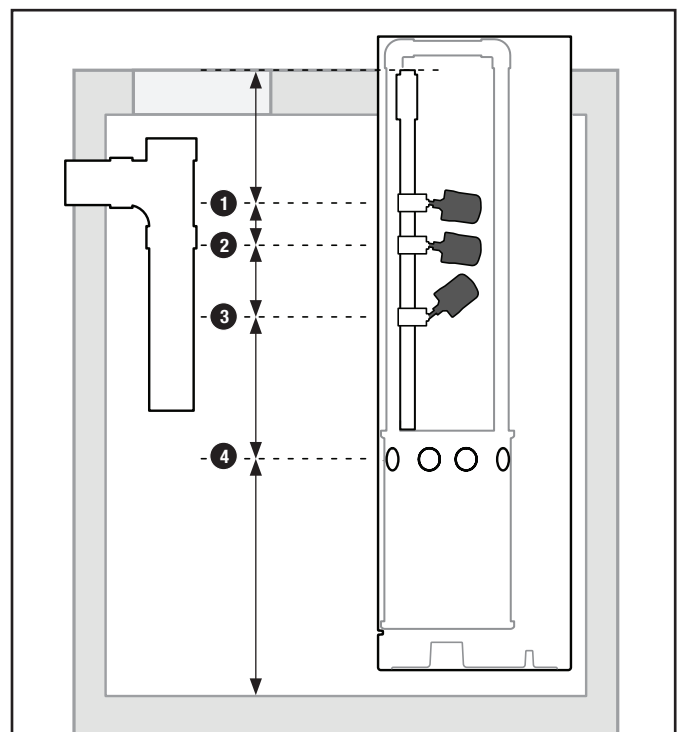


Figure 3. Dual-Compartment Septic/Dosing Tank with Shared Liquid Level (PVU Vault Shown)



1. “High-level alarm” float switch location (invert of the tank inlet as measured from the outside top of the tank)
2. “On” float switch location (2in or 51mm below “High-level alarm” float switch)
3. “Off” float switch location (about 3in or 75mm below “On” float switch)
4. Pump vault inlet/inlet hole location (about 70% of the distance between the tank bottom and the “Off” float switch – the lowest operating liquid level)

Figure 4. Standard Settings: Three-Float Switch, Demand-Dose System (PVU Vault Shown, Not to Scale)

Float Switch Settings, cont.

Standard settings for float switches in demand-dose systems are as follows:

- “High-level alarm” float switch – At the invert of the inlet of septic/dosing tank, as measured from the outside top of the tank.
- “On” float switch – 2in (51mm) below the “High-level alarm” float switch.
- “Off” float switch – 2-4in (51-102mm) below the “On” float switch. The amount of space between the “On” and “Off” float determines dose volume.

NOTE: The on/off function may be controlled by one float switch. In this case, dose volume will be constrained by the drawdown of the “On/Off” float switch.

Timed-dose systems are typically used to pump effluent to soil, sand, or media filters for additional treatment. The operating zone should be sized as small as possible while allowing for 24hrs of estimated daily flow storage. To balance the need for a small operating zone with the need for flow storage capacity, we recommend using single-compartment tanks or tanks with shared liquid levels for timed-dose applications.

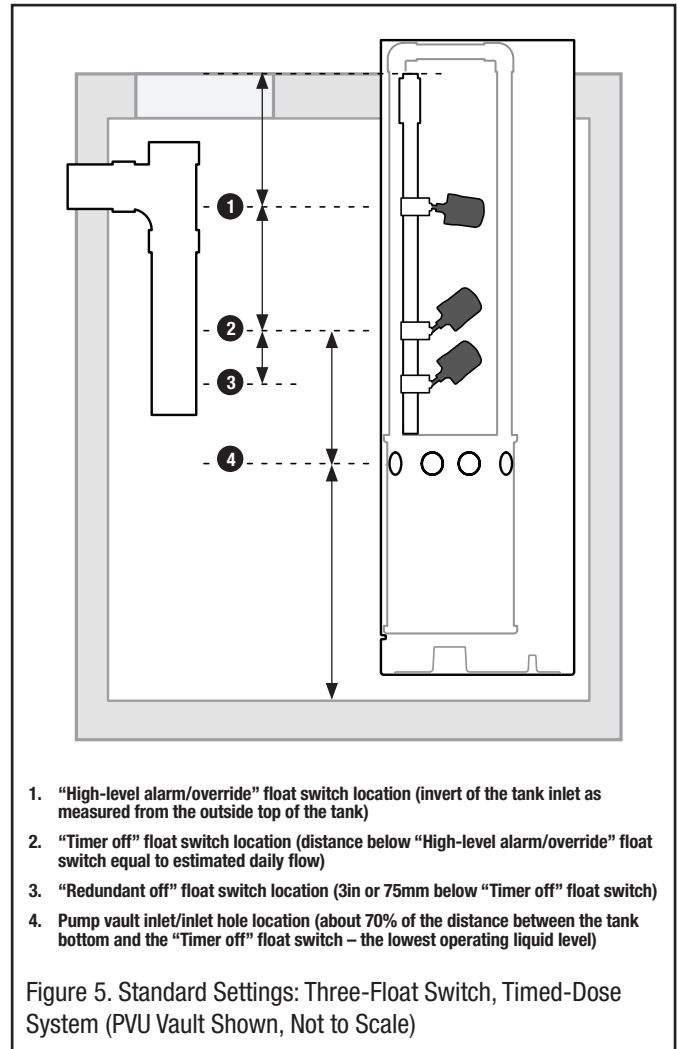
Timed-dose float switch settings: For a single-family dwelling, wastewater flows typically range from 40 to 60 gallons per capita per day (gpcd) or 150 to 227 liters per capita per day (Lpcd). A design parameter of 50gpcd (190Lpcd) is commonly used in determining estimated flows from a dwelling. Estimated flows are determined by multiplying the number of occupants in the dwelling by 50gpcd (190Lpcd). Figure 5 shows general guidelines for float switch placement:

- “High-level alarm/override” float switch – This switch is placed at the invert of the inlet in the septic/dosing tank, as measured from the outside top of the tank. The high level alarm function is combined with the override function. (Some jurisdictions require separate float switches for high level alarm and override functions. When a single-function float switch is used for the override function, it is typically set at 2in or 51mm below the “High-level alarm” float switch.)
- “Timer off” float switch – This float switch is set at a distance below the “High-level alarm” float switch or the “Override” float switch, equal to the estimated flows for the system. (Example: a home with 4-person occupancy would be set for estimated flows of 200gpd (757Lpd) or $50\text{gpcd} \times 4$ (190Lpcd $\times 4$).
- “Redundant off” float switch settings – A “Redundant off” float switch may be used with both demand-dose and timed-dose systems. The “Redundant off” float switch is placed 2-3in (51-76mm) below the “Off” float switch in demand-dose systems or the “Timer off” float switch in timed-dose systems.

Float switch settings for both types of dosing systems also need to account for reserve volume in the septic/dosing tank. The reserve volume is the portion of the tank from the soffit of the tank to the invert of the tank inlet (“High-level alarm” float switch setting). Reserve volumes should be capable of storing 24-48hrs of estimated daily flows.

Drainfield Considerations

When designing the pump system for any type of low-pressure dispersal system (pressure drainfields, mounds, etc.), the best design practices address equal distribution and supply of frequent, small doses for dispersal. This maintains the oxygen supply to microbes and promotes the best possible aerobic treatment. Using small-diameter laterals (typically 1in or 25mm) and orifices (typically 1/8in or 3.2mm) helps to ensure equal distribution of effluent in a dispersal system.



Appendix A. 4in (100mm) Turbine Effluent Pumps

In on-site wastewater and pressure distribution systems, Orenco's 4in (100mm) turbine effluent pumps are commonly used because of several advantages they offer compared with other types of pumps in those applications:

- Cycle life – They regularly reach lifetime cycle counts of more than one million.
- Scouring velocity – They provide more than sufficient energy to flush laterals and help keep orifices clear.
- Run-dry capability – They have run-dry capability with no deterioration in pump life or performance.
- Durability – They can operate for extended periods in the “no discharge” condition or at heads greater than the maximum “shut-off” head.
- Maintainability – A ½hp (0.37kW) turbine pump weighs about 25lb (11.3kg) and can be removed by one person for maintenance or repairs without the need for a lifting mechanism.
- Abrasion and corrosion resistance – Orenco's pumps are constructed entirely of 300-Series stainless steel and thermoplastics.
- Warranty period – Orenco provides a 3yr or 5yr warranty on its 4in (100mm) turbine effluent pumps.

Appendix B. Control Panels

Orenco's simplex control panels provide pump control based on dose method. Demand-dose panels are specifically engineered for pumping from dosing tanks into such applications as conventional gravity systems. Timed-dose panels are specifically engineered for applications that require programmable timers, such as pressurized drainfields and secondary treatment systems. Shared features of both control panels include the following:

- Motor-start contactor for increased system life
- 20A Auto/Off/Manual toggle switch for easy troubleshooting and maintenance
- Resettable control circuit breaker that negates the need for easily lost or forgotten fuses
- Discrete, touch-safe terminal locations for simple, intuitive pump and float switch wiring
- Fiberglass enclosure for increased durability over plastic
- Easily accessed external “Push to Silence Alarm” button for homeowner control over audible alarms

Demand-dose panels include the following features:

- Audible and visual alarms to signal high-level conditions
- Audible alarm silence relay keeps the audible alarm off until power is removed then restored
- Auto reset feature resets the alarm when the tank liquid level returns to normal

Timed-dose panels include the following features:

- Choice of digital or analog timers
- Digital timers accurate to within 1%
- Multiple timer settings allow for optimum dosing during both normal and peak flow conditions
- Built-in programming keys for adjusting timer settings in the field without a portable computer
- Built-in elapsed time meter and counters
- Audible and visual alarms to signal high- and low-level conditions
- High- and low-level alarm conditions differentiated by steady or blinking light
- Silenced alarms automatically reactivated after 12hrs if condition is not corrected
- Timed delays on float switch inputs to prevent chattering
- Visual indicators of float switch positions